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Analysis

Spatial patterns of organic agriculture adoption: Evidence from Honduras

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ABSTRACT

In low potential agricultural areas like the Honduran hillsides characterized by soil degradation and erosion, organic agriculture can provide a means to break the downward spiral of resource degradation and poverty. We use original survey data to analyze the factors influencing the decision to convert to organic agriculture. Previous studies have emphasized the role of spatial patterns in the diffusion and adoption of agricultural technologies in general and organic agriculture in particular. These spatial patterns can result from a variety of underlying factors. In this article we test various potential explanations, including the availability of information in the farmer's neighborhood, social conformity concerns and perceived positive external effects of the adoption decision, in a spatially explicit adoption model. We find that farmers who believe to act in accordance with their neighbors' expectations and with greater availability of information in their neighborhood network are more likely to adopt organic agriculture. Furthermore, perceived positive productivity spillovers to neighboring plots decrease the probability of adoption. We discuss the implications of our findings for the dissemination of sustainable agricultural technologies in low-potential agricultural areas in developing countries.

1. Introduction

In many regions in developing countries, rural households depend on marginal lands to make a living. Low-potential agricultural areas include for example hillsides that are heavily exposed to soil erosion and degradation (Ruben and Pender, 2004). Often poor rural households lack the resources to invest in chemical fertilizers thus finding themselves trapped in a downward spiral of low soil fertility, low agricultural productivity, poverty, and low investment capacities (Blackman et al., 2007; Marenya and Barrett, 2007; Ruben and Pender, 2004; Wollni et al., 2010). In this context, organic farming that relies on soil conservation measures and organic manure to restore and maintain soil functions could potentially provide a promising approach to break the vicious cycle of poverty and resource degradation. In particular, for households that already use low levels of external inputs switching costs to organic agriculture are very low and often conversion goes hand in hand with an increase in yields resulting from the application of improved soil management practices (Bolwig et al., 2009). In addition, if farmers gain access to organic markets, they can potentially benefit from premium prices paid for organic produce (Giovannucci and Ponte, 2005).

Previous research has analyzed the factors influencing the decision of farmers to convert to organic agriculture (e.g. Hattam et al., 2012; Läpple and Kelley, 2013; Läpple and van Rensburg, 2011; Musshoff and Hirschauer, 2008; Schmidtner et al., 2012).[1] Several adoption studies yield evidence for the importance of information access and particularly the role of informal information sources for organic farmers (Burton et al., 1999; Genius et al., 2006; Morone et al., 2006) and the relevance of motivational factors such as environmental concern for the adoption decision (Best, 2010; Mzoughi, 2011). Furthermore, a growing number of studies focus on the role of spatial effects in the adoption process and find evidence for the spatial clustering of organic farming (Bichler et al., 2005; Bjorkhaug and Blekesaune, 2013; Eades and Brown, 2006; Frederiksen and Langer, 2004; Nyblom et al., 2003). This evidence, however, is mostly based on data from developed countries, including e.g. county level data from Germany (Schmidtner et al., 2012), as well as farm level data (Lewis et al., 2011) and plot level data (Parker and Munroe, 2007) from the US. While research on the spatial patterns of organic agriculture adoption in developing countries

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[1] Also see Padel (2001) for a review of adoption studies focusing on organic farming.

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is scarce, there is increasing evidence on the role of neighborhood effects and social interactions[2] in the adoption of agricultural technologies more generally (Bandiera and Rasul, 2006; Best et al., 1998; Case, 1992; Conley and Udry, 2010; Holloway et al., 2002; Staal et al., 2002). Most of these studies find positive spatial and social interaction effects indicating that agricultural decisions of neighboring farmers are not independent of each other.

Manski (2000) criticizes that while many studies detect positive correlations in the agricultural decisions of neighbors, they usually do not shed much light on the underlying processes explaining the spatial patterns of technology adoption. Spatial dependence in technology adoption decisions is usually attributed to agglomeration economies associated with cost reductions that result from greater availability of knowledge and high-quality extension, when neighboring farmers are also adopters (Lewis et al., 2011; Schmidtner et al., 2012). The importance of informal information exchange is likely to be especially high in low potential areas characterized by a general scarcity of information and by long distances to main markets and commercial centers. In the absence of formal information sources, knowledge on new technologies has to be obtained through informal channels from neighbors and friends. However, besides agglomeration economies associated with access to information, other factors may be of relevance in these settings that also contribute to the observed spatial patterns of technology adoption. For example, farmers may derive increased utility from social conformity and therefore make their adoption decision contingent on their neighbors' acceptance (Läpple and Kelley, 2013; Moser and Barrett, 2006). Furthermore, perceived externalities of the adoption decision, such as positive or negative productivity effects on neighboring plots, may influence the farmer to postpone adoption until more farmers in the neighborhood have adopted (Knowler and Bradshaw, 2007; Lee, 2005).

A deeper understanding of the processes and factors contributing to the spatial concentration of observed outcomes is of paramount importance to refine policy instruments for the dissemination of agricultural technologies in developing countries (Holloway and Lapar, 2007; Manski, 2000). In particular, it is crucial to understand whether the adoption decision is influenced mainly at the individual level and thus can be directly influenced by extension agents and service provision aimed at overcoming the barriers to adoption at the household level. Or, alternatively, whether the decision is to a large extent influenced by processes that take place at the level of communities and social networks, where members engage in social learning shaping collective expectations and norms and where coordination problems may arise (Lee, 2005; Manski, 2000). Understanding the role of individual versus collective forces in the diffusion of sustainable agricultural technologies can help policy-makers to prioritize between programs that target either individual households or neighborhood networks and communities to effectively induce behavioral changes.[3]

We extend the existing literature in two major ways. First of all, we seek to disentangle the underlying factors that contribute to explaining spatial patterns in organic agriculture adoption. We do this by integrating factors related to social conformity, perceived externalities of adoption, access to information, and location proxies into a spatially explicit adoption model. Secondly, while most studies on the spatial effects of organic agriculture adoption have been conducted in developed countries, our study is based on data from Honduran hillside farmers. It thus contributes to enhancing our understanding of the factors shaping organic agriculture adoption in a developing country context. Our research area is characterized by low agro-ecological potential, high levels of land degradation, and persistent poverty. In this context, the adoption of organic agriculture practices can potentially provide an avenue out of the "resource degradation poverty trap" (Barrett et al., 2002). Yet, information about technologies and markets from formal information sources is scarce, and therefore, informal information networks like neighbors and fellow farmers are likely to play a crucial role in the transmission of information about new technologies. Similarly, in traditional communities like the ones in our research area, where many farmers depend on subsistence agriculture and informal insurance networks, non-conformity with social norms and expectations can have tangible repercussions on farmers' livelihoods. The remainder of this article is organized as follows. The next section discusses the role of spatial effects in organic agriculture adoption from a conceptual perspective. Section three details the methodological approach used to analyze the data. Afterwards we describe the research area, the empirical data, and the variables included in the analysis. Descriptive and econometric results are presented in section five. Finally, section six derives policy implications and concludes the article.

2. The Role of Spatial Effects in Organic Agriculture Adoption

A growing body of literature focuses on the role of spatial patterns in the adoption of agricultural technologies. In particular, various studies have found that the adoption of organic agriculture is spatially clustered (Lewis et al., 2011; Nyblom et al., 2003; Parker and Munroe, 2007; Schmidtner et al., 2012). A variety of underlying spatially correlated processes and factors can potentially contribute to explaining these observed spatial patterns in technology adoption outcomes. First and foremost, agglomeration economies may explain spatial clustering of organic agriculture. Agglomeration economies stem from reduced production costs, better access to skilled labor, information, and improved service and input supplies for individual firms associated with the spatial concentration of firms pursuing similar activities. Krugman (1996) and Fujita et al. (1999) describe the relevance of agglomeration economies in the context of non-agricultural industries. Porter (2000) in his work focuses specifically on knowledge spillovers that accelerate the spread of innovations in industry clusters. This has triggered a growing body of literature on social learning and network effects in agricultural technology adoption in developing countries (Bandiera and Rasul, 2006; Conley and Udry, 2010; Foster and Rosenzweig, 1995). According to this literature, the more farmers in the individual's information neighborhood have adopted the new technology, the more information about the new technology is available to the individual. As a result, the fixed costs of learning can be substantially reduced for individual farmers (Lewis et al., 2011). These positive information externalities are likely to be especially relevant in information-scarce environments as is often the case in remote, low-potential areas in developing countries. Furthermore, they may be especially relevant in the case of knowledge-intensive technologies, such as low-external-input and organic agriculture (Lee, 2005). Consequently, if information about particular agricultural technologies is spatially clustered, we can expect to observe spatial patterns in the diffusion and uptake of these practices.

Besides agglomeration economies resulting from knowledge spillovers, previous studies have stressed the role of social conformity considerations in the technology adoption decision of farmers in developing countries. In traditional rural societies there is often strong social pressure regarding compliance with desired behavior and cultural norms (Platteau, 2000). The compliance with these norms and expectations may influence a farmer as much or even more than profit considerations (Moser and Barrett, 2006). Especially in low-potential areas, social networks at the village level are often of vital importance for farmers in case they experience a negative shock. Social conformity in

[2] Positive social interaction effects refer to the effects that result from communication and information exchange between individuals. Several authors, instead of using geographic proximity, have used survey data on communication patterns between households as a basis to construct an information neighborhood matrix (e.g. Conley and Udry, 2010).

[3] See Manski (2000) for a more comprehensive discussion of this argument.